

What is claimed is:

1. A system for cooling coated semiconductor substrates, comprising:
a chamber adapted to receive one or more coated semiconductor substrates;
a coupling for placing the chamber in fluid communication with a fluid reservoir;
an inlet valve for controlling the flow of fluid between the fluid reservoir and the chamber; and
a controller that controls the inlet valve.
2. The system of claim 1 wherein the coupling is attached to a fluid reservoir and the pressure drop across the inlet valve is at least about 10 bar.
3. The system of claim 2 wherein the pressure drop across the inlet valve is at least about 100 bar.
4. The system of claim 1 wherein the controller controls the temperature of the fluid at a point within the chamber.
5. The system of claim 1 further comprising an outlet valve controlling the flow of fluid out of the chamber, wherein the controller also controls the outlet valve.
6. The system of claim 5 wherein the controller controls the rate of fluid flow through the chamber.
7. The system of claim 1 wherein the fluid entering the chamber from the reservoir substantially mixes with fluid already in the chamber before contacting the substrates.
8. The system of claim 7 wherein the fluid flowing into the chamber is

directed against a baffle.

9. A system for cooling coated semiconductor substrates comprising:
means for cooling a fluid by at least about 10 °C through the Joule-Thompson effect; and
means for contacting the substrates with the cooled fluid.

10. The system of claim 9 comprising means for cooling the fluid by at least about 25 °C through the Joule-Thompson effect

11. A method of cooling coated semiconductor substrates, comprising:
cooling a fluid by at least about 10 °C through the Joule-Thompson effect; and
contacting the substrates with the cooled fluid.

12. The method of claim 11 wherein the temperature of the cooling fluid is varied during the cooling process.

13. The method of claim 11 wherein the substrates are in a chamber and the temperature and/or flow rate of the cooling fluid entering the chamber are varied to maintain an approximately constant difference between the average fluid temperature in the chamber and the average substrate temperature.

14. The method of claim 11 wherein the pressure in the chamber is maintained at or above about 2 bar.

15. The method of claim 11 wherein the cooling fluid is heated before it is cooled.

16. The method of claim 11 wherein the temperature within and among the substrates never varies by more than about 2 °C over the course of the cooling process.

17. The method of claim 11 wherein the substrates are cooled within a chamber within which the substrates were previously heated.

18. The method of claim 11 wherein the flow rate of the cooling fluid is varied during the cooling process.

19. A method of cooling coated semiconductor substrates, comprising:
heating a fluid to a temperature above ambient;
subsequently flowing the fluid into a chamber containing the substrates; and
cooling the substrates by contacting them with the fluid.

20. The method of claim 19 wherein the temperature of the fluid entering the chamber is varied as the substrates cool.

21. A system for cooling coated semiconductor substrates, comprising:
a first sub-system for cooling a fluid using the Joule-Thompson effect;
and
a second sub-system for contacting the coated semiconductor substrates with the cooled fluid.